

Iowa Department of Natural Resources Environmental Protection Commission

ITEM

13

DECISION

TOPIC **Contract – City of Marion – Economic Analysis of a Plasma Arc
Waste-to-Energy Facility**

Recommendation:

The Department requests Commission approval of a contract not to exceed \$150,000 with the City of Marion for seven (7) months to accomplish the following three objectives:

- To study the commercial application potential of plasma arc gasification technology as an alternative to landfill disposal of municipal solid waste.
- To develop a conceptual Pro Forma for a third party partnership who will build, own, and operate the plasma arc facility.
- To study the impacts of the construction of such a facility on the local and state economy.

Funding Source:

This project is funded through a legislative appropriation from the Rebuild Iowa Infrastructure Fund to the Department of \$150,000.

Background:

Senate File 2432, passed during the 2008 legislative session, provided funding (\$150,000) and authorizing the Department to award a grant to a city within certain population parameters to conduct a study of the feasibility of the use of plasma arc and other related energy technology for disposal of solid waste while generating energy. The City of Marion met these population parameters.

Plasma arc technology is a potential waste treatment technology that uses high electrical energy and high temperature to break down waste material by melting the inorganic portion and destroying the organic portion. Materials are not incinerated but rather the heat from plasma converters causes pyrolysis where organics break down and decompose. The process is intended to be a net generator of electricity while reducing the volume of waste being sent to the landfill. In general, by-products of the process include synthetic gas (syngas), slag and heat.

- Syngas, can be used to generate electricity to power the facility or sold to the power grid or cleaned and used in fuel cells.
- Slag is the solid by-product. Its weight and volume are significantly reduced from its original form. Potential uses for slag include concrete/asphalt, paving brick, insulation, or as an absorbent depending on the method employed during the cooling process.
- Heat production is considerable. It can be used to maintain the furnace temperature or to convert water to steam and then used to turn steam turbines to generate electricity.

Purpose:

The purpose of this contract is to accomplish three (3) main objectives:

- To study the commercial application potential of plasma arc gasification technology as an alternative to dispose of municipal solid waste. End products will include electricity for

commercial sale and potential secondary products, such as ethanol, methanol, rock wool, biodiesel, steam, or others. To examine economic benefits of such a facility and determine which secondary product is the most profitable within the Midwestern economy.

- The study will include development of a conceptual Pro Forma for a third party partnership who will build, own, and operate the plasma arc facility. The University of Iowa, a partner in the study, is interested in the potential of using plasma arc technology as a source of renewable energy. The University of Iowa is also interested as a customer for the renewable energy (syngas, electric, thermal) produced by the facility.
- To study the impacts of the construction of such a facility on the local and state economy.

The study will:

- Examine available plasma arc gasification systems to determine which is best suited to dispose of municipal solid waste, with potential other feedstocks such as hazardous waste, animal, and commercial waste with the highest reliability and lowest operating cost;
- Determine the most reasonable alternative and pricing structure for the marketing of power produced at a plasma arc gasification facility;
- Look at potential markets and cost of production for several secondary products such as rock wool, ethanol, methanol, biodiesel, steam and others as needed to determine which has the best positive impact on the profitability of the facility;
- Prepare an analysis of the “rightsizing” of the facility, as determined by the point at which the size of the facility makes operations most profitable;
- Prepare a summary report of the expected economic impact construction and operation of such a facility in the City of Marion on a regional and statewide level; and
- Identify optimal site location for a facility to serve the University of Iowa, given the University would serve as the sole, and long-term customer for purchase of energy (syngas, electric, thermal) produced by the facility.

Consulting Firm Selection Process:

The City of Marion was chosen as the contractor based on conditions set out in Senate File 2432. The City of Marion has completed a subcontractor selection search. SCS Engineers was selected by the City as the firm most capable to meet the objectives of this economic analysis.

Scope of Work:

The Scope of work is attached.

Ed Tormey, Chief
Legal Services Bureau

February 26, 2009

SCOPE OF SERVICES

TASK 1. KICK-OFF

Kick-Off Meetings

SCS will attend kick-off meetings in Marion to meet all of the stakeholders in the project and to discuss and confirm the primary aspects of the project. Selected members of the SCS team including the Project Manager, Economic Analyst, and Secondary Materials Specialist will attend, however, not all team members need to attend.

Topics to be discussed include;

- Scope of services
- Project team members
- Lines of communication
- Utility representatives
- Schedule
- Key Deliverables
- Web site aspects
- Request for prior data and reports
- Initial tour of the University of Iowa (University) (i.e., relevant to the project).

Data Collection

Following the meeting, SCS will initiate the collection of existing background data and prior reports (those which are readily available) for use in developing information on future tasks on the project including;

- Solid Waste Volume Projections
- Current Waste Disposal Facilities and Volume
- Recent Waste Stream Characterization
- Summary of Waste Collection Systems
- Summary of Relevant Recycling Programs

TASK 2. ASSESSMENT OF WASTE FEEDSTOCK AND PRODUCT MARKETS

Waste Feedstocks

SCS will compile information on the most-promising potential waste feedstocks, in addition to the municipal solid waste (MSW) stream, that are generated in the region. Materials from livestock and agricultural production and perhaps certain industrial manufacturing operations will be considered and evaluated as to; projected volumes, availability, cost, chemical characteristics, fuel value, and regulatory considerations.

Secondary Products Markets

SCS will conduct an assessment of the potential market in the region for by-product streams generated by the plasma arc gasification technology. These streams could potentially include;

- Production gas or syngas (not dedicated to power production)
- Ash or char
- Production liquids, if any
- Waste heat
- Exhaust gas from power production equipment

Possible uses and markets of these by-products could include, but not be limited to; alternative vehicle fuels, substitute ingredients for construction materials, and steam and space heat production. Local organizations such as the Farm Bureau, WasteNotIowa, local and state regulators, industry trade groups, and others will be contacted to obtain available information and guidance.

The assessment will include the following:

- Identification of by-product markets; local and regional
- Downstream preparation needs and estimated costs
- Available commercial processing systems
- Regulatory permitting aspects
- Estimated final product volume, chemical characteristics
- Other relevant aspects (i.e., compatibility and integration with the University systems).
- Which secondary material may be the most profitable.

SCS will prepare a draft summary memorandum of its initial findings for review by the City. The memorandum findings will be carried forward into the final report in Task 6.

TASK 3. DATA REVIEW OF PLASMA ARC SYSTEMS

Plant Vendor Systems Review

SCS will review the plasma arc gasification technology from at least three vendors that have an operating record for providing a complete system (from front-end waste processing to power production) at a pilot scale or larger facility, preferably in North America. Note that this effort does not address the plasma arc technology as related to its ability to utilize MSW as a feedstock (this having been addressed by prior City investigations).

Initially, SCS will make contact with the vendors to obtain basic information and reference information on aspects of their technology including:

- Compatibility with proposed waste stream(s);
- Compatibility with proposed waste volumes
- Major plant components; description, design aspects, manufacturers, etc.
- Plant footprint and layout
- Potable water needs and waste water discharges;
- Anticipated by-product streams, volumes and characteristics
- Operating performance of existing facility
- Vendor resources; engineering, construction and operations
- Summary of plant operating problems, major shut-downs, etc.

Possible Plant Site Locations

SCS will assess possible locations for the plant in the vicinity of the University campus, given that the University will be the sole long-term customer for the power. SCS will contact a local property advisor to inquire, in general, about tracts potentially available for an industrial use.

SCS' review would include information furnished by the University, the City, or WasteNotIowa, on potentially available tracts of land. SCS will assess the tracts to determine the optimal location including consideration of the following elements; size, relative location, utility connections, zoning, adjacent land uses, known environmental problems, and road and traffic conditions suitable for trash trucks.

At the conclusion of all the elements in this Task, SCS will prepare a draft summary memorandum of its initial findings for review by the City. The memorandum findings will be carried forward into the final report in Task 6.

TASK 4. ASSESSMENT FOR MARKETING OF POWER

The power pricing structure assessment will consider key factors that will have an effect on the ultimate users and price including:

- Amount of surplus power available
- Availability of power throughout the day
- Interconnect characteristics (utility and/or University)
- Number and type of users and power requirements
- Interface with local utility and power wheeling opportunity
- Industrial/commercial conventional power costs

SCS will recommend from the assessment the most reasonable alternative and pricing structure for the marketing of power produced at the plant (based on data provided by the vendors), including consideration of wholesale marketing to companies and internal sales to an industrial park, etc.

SCS will prepare a draft summary memorandum of its initial findings for review by the City. The memorandum findings will be carried forward into the final report in Task 6.

TASK 5. ECONOMIC ANALYSIS OF PLANT

Vendor Economic and Financial Information

Assuming that the plant could be provided by outside vendors on a turn-key basis (i.e. design-build-operate), SCS will solicit from several vendors a written prospectus for a proposed planning-level plant with a stated minimum capacity that will require from the vendors:

- A stated capacity and annual throughput
- Estimate for capital costs and other development costs (i.e., financing, etc.)
- Anticipated operating and maintenance costs for first year, including debt service
- Estimated revenue from the sale of power
- The affect of the sale or disposal of any by-products (as an operating cost)
- An estimate of the tipping fee
- Entities proposed for final design, construction and operations.

This information will be compared later to SCS' pro-forma results and allow independent verification of the vendor planning level economics.

Pro-Forma

SCS will prepare a pro-forma economic analysis to independently estimate the anticipated revenues and expenses projected over the projected life for the facility. This will be used to right-size the facility, recommend proposed tipping fees for customers of the project, and forecast the anticipated return on investment to the City, the University, and other stakeholders.

Key variables in the model will include the following:

- Projected disposal capacity
- Annual capacity increase

- Current disposal cost
- Contract operation period
- Interest rate
- Capital cost
- Annual O&M cost
- Cost escalation factor
- Disposal rate for ash and slag
- Wholesale and retail power price
- Plant net power output
- Revenue from sale of recyclables
- Potential revenue from carbon credits

Once the model base parameters are established, parameters can be changed to assess sensitivity and the best rate of return under a variety of possible conditions.

Economic Projections

SCS will develop projections for the local and possibly regional economic benefits of the plant including; direct jobs creation, jobs for constructing and operating the plant, associated new businesses, and secondary materials markets, property taxes, economic multiplier effects, etc.

At the conclusion of all the elements in this Task, SCS will prepare a draft summary memorandum of its initial findings for review by the City. The memorandum findings will be carried forward into the final report in Task 6.

TASK 6. FINAL REPORT

SCS will prepare a final draft report which will incorporate the findings, conclusions and recommendations in the Task memorandums and other relevant information prepared to that time. The report will address whether the proposed plant appears to be economically viable given the conditions, and will provide recommendations for future planning activities consistent with the City's goals.

SCS will solicit review comments from the stakeholders on the draft report. This will be accomplished through e-mail. Following receipt of comments, SCS will hold a teleconference to discuss the comments and obtain any clarifications or provide additional information. SCS will then incorporate the comments into a final draft version of the report. Once the City accepts the final version of the report, SCS is prepared to give a presentation of the report in Task 7.

The individual Task summary memorandums and final report will be able to be integrated into the City's and WasteNotIowa websites and hard copies available to these entities. Hard copies of the report will be provided by SCS to the City for distribution to interested members of the public. SCS will also provide the City a complete ".pdf" format version of the final report on CD.

For budgeting purposes, SCS will provide 10 hard copies of the final report for the public. More copies can be provided and an additional fee for production can be negotiated with the City if necessary.

TASK 7. PRESENTATIONS

SCS will present the report findings to the City, WasteNotIowa, the University and other stakeholders. SCS assumes for budgeting purposes that two identical presentations will be provided, on the same day, one in the morning and one in the evening, so that all interested parties have an opportunity to attend.